**III. CLAIMS**

1. (Original) A method of producing a full form net shape roll finished contacting machine element from a near net shape workpiece of wrought or forged steel having an initial outer peripheral contoured surface and including a plurality of teeth, each having a tooth flank with a nominally involute surface and a root/fillet region with a trochoidal surface, the method comprising the steps of:

rotatably supporting on a first axis a rolling die having an outer peripheral contoured surface extending between generally parallel spaced lateral surfaces transverse to the first axis, the rolling die including a plurality of teeth, each including a tooth flank with opposed involute surfaces and a tooth tip surface;

rotatably supporting the workpiece on a second axis distant from and parallel to the first axis;

advancing the rolling die in an in-feed direction generally perpendicular to the first and second axes such that the rolling die meshingly engages with the workpiece,

rotating the rolling die about the first axis while engaged with the workpiece;

while performing step (d), maintaining continuous conjugacy between the rolling die and the workpiece with the involute surface of each tooth of the rolling die engaging the involute surface of a mating tooth of the workpiece and the tooth tip of the rolling die engaging the trochoidal root/fillet surface between adjacent mating teeth of the workpiece to effect material flow along the outer peripheral contoured surface;

continuing to advance the rolling die in the in-feed direction thereby deforming the surface of each tooth flank and of a corresponding root/fillet region until a final net shape of each tooth and root/fillet region is achieved, and

continuing to perform all of the preceding steps with the rolling die and workpiece meshingly engaged, thereby deforming the involute and trochoidal root/fillet surfaces of all of the teeth of the workpiece resulting in a final net shaped machine element.

2. (Original) A method as set forth in claim 1 including the step, before step (c) of:

advancing the workpiece in a through-feed direction parallel to the first and second axes such that the outer peripheral profiled surface of the workpiece engages the outer peripheral profiled surface of the rolling die and continues to advance until the workpiece is positioned substantially

coextensive with the rolling die in the through-feed direction.

3. (Original) A method as set forth in claim 1 wherein the machine element being produced is a gear.

4. (Original) A method as set forth in claim 1 wherein the machine element being produced is a sprocket.

5. (Original) A method as set forth in claim 2 wherein step (c) includes the steps of:

simultaneously with step (g) after the workpiece and rolling die are substantially enmeshed, advancing the rolling die within a plane containing the first and second axes, in an in-feed direction substantially perpendicular to the first and second axes until the outer peripheral surface of the rolling die engages the outer peripheral surface of the workpiece at a near net shaped center distance establishing an initial center distance between the first and second axes when the workpiece and the rolling gear die are initially engaged; and

continuing to advance the workpiece in the in-feed direction by an additional increment of center distance thereby

deforming the profile surfaces of each tooth resulting in final net shape of the teeth.

6. (Withdrawn) A method of producing a rolling die for, in turn, producing a full form net shape roll finished contacting machine element comprising the steps of:

providing a cylindrical grinding wheel having an initial outer peripheral surface generally shaped to correspond to the space between two adjacent teeth of a rolling die and rotatable about an axis;

dressing the grinding wheel by advancing a peripheral edge of a disk-shaped dressing tool into engagement with the initial outer peripheral surface of the grinding wheel to remove material therefrom to thereby produce a grinding wheel final profile with a desired contoured outer surface;

supporting on an axis which lies in a plane parallel to the plane of the grinding wheel axis but perpendicular to the grinding wheel axis a cylindrical rolling die blank having a plurality of circumferentially spaced near net shaped teeth, each pair of adjacent teeth having opposed tooth surfaces and a common root/fillet region therebetween;

advancing the grinding wheel radially toward and into engagement with the rolling die blank such that the

contoured outer surface thereof engages the opposed tooth flanks and the common root/fillet region between two adjacent teeth of the rolling die blank;

simultaneously with step (d), rotating the grinding wheel about its axis to produce a final tooth profile for the opposed tooth surfaces and the common root/fillet region;

withdrawing the grinding wheel from engagement with the rolling die blank;

rotating the rolling die blank on its axis by an increment equal in arc length to the pitch between adjacent teeth thereof so that the grinding wheel is aligned with the opposed tooth surfaces and common root/fillet region of the next successive pair of adjacent teeth of the rolling die blank;

repeating steps (d), (e), (f), and (g) until all of the teeth of the rolling die blank have been ground to the desired shape of the rolling die.

7. (Withdrawn) A method of producing a rolling die as set forth in claim 6 wherein the dressing tool of step (b) includes a diamond roll having a tip radius in the range of about 0.005 inches to about 0.012 inches.

8. (Withdrawn) A method of producing a full form net shape roll finished contacting machine element from a near net shape workpiece having an initial outer peripheral contoured surface and including a plurality of teeth, each having a tooth flank with a nominally involute surface and a root/fillet region with a trochoidal surface, the method comprising the steps of:

providing a cylindrical grinding wheel having an outer peripheral surface and rotatable about an axis;

dressing the grinding wheel by advancing a dressing tool into engagement with the outer peripheral surface to remove material therefrom to thereby produce a grinding wheel profile having a desired contoured outer surface;

supporting on an axis which lies in a plane parallel to the plane of the grinding wheel axis but perpendicular to the grinding wheel axis a cylindrical rolling die blank having a plurality of circumferentially spaced near net shaped teeth defining an arcuate pitch length between adjacent teeth, each pair of adjacent teeth having opposed tooth surfaces and a common root/fillet region therebetween;

advancing the grinding wheel radially toward and into engagement with the rolling die blank such that the contoured outer surface thereof engages the opposed tooth surfaces and the common root/fillet region between two adjacent teeth of the rolling die blank;

simultaneously with step (d), rotating the grinding wheel about its axis to produce a final tooth profile for the opposed tooth surfaces and its common root/fillet region;

withdrawing the grinding wheel from engagement with the rolling die blank;

rotating the rolling die blank on its axis by an increment equal in arc length to the pitch between adjacent teeth thereof so that the grinding wheel is aligned with the opposed tooth surfaces and common root/fillet region of the next successive pair of adjacent teeth of the rolling die blank;

repeating steps (d), (e), (f), and (g) until all of the teeth of the rolling die blank have been ground to the desired shape and resulting in a finished rolling die;

rotatably supporting the finished rolling die on a first axis a rolling die having an outer peripheral contoured surface extending between generally parallel spaced lateral surfaces transverse to the first axis, the rolling die including a plurality of teeth, each including a tooth flank with opposed involute surfaces and a tooth tip surface;

rotatably supporting the workpiece on a second axis distant from and parallel to the first axis;

advancing the rolling die in an in-feed direction generally perpendicular to the first and second axes such that the rolling die meshingly engages with the workpiece,

rotating the rolling die while engaged with the workpiece;

while performing step (l), maintaining continuous conjugacy between the rolling die and the workpiece with the involute surface of each tooth of the rolling die engaging the involute surface of a mating tooth of the workpiece and the tooth tip of the rolling die engaging the trochoidal root/fillet surface of a mating tooth of the workpiece; and

continuing to advance the rolling die in the in-feed direction thereby deforming the surface of each tooth flank and of a corresponding root/fillet region until a final net shape of each tooth and of each root/fillet region is achieved, and

continuing to perform steps (i), (j), (k), (l), (m), and (n) with the rolling die and workpiece meshingly engaged, thereby deforming the involute and trochoidal root/fillet surfaces of each tooth of the workpiece resulting in a final net shape of all of the teeth thereof.

9. (Original) A method of producing a full form net shape roll finished contacting machine element from a near net shape workpiece of wrought or forged steel having an initial outer

peripheral contoured surface and including a plurality of teeth, each having a tooth flank with a nominally involute surface and a root/fillet region with a trochoidal surface, the method comprising the steps of:

rotatably supporting on first and second generally parallel spaced axes, first and second rolling dies, each having an outer peripheral contoured surface extending between generally parallel spaced lateral surfaces transverse to the first axis, each rolling die including a plurality of teeth, each tooth including a tooth flank with opposed involute surfaces and a tooth tip surface;

rotatably supporting the workpiece on a third axis distant from and parallel to the first and second axes;

advancing the first and second rolling dies, within a common plane generally containing the first, second, and third axes in respectively opposite in-feed directions generally perpendicular to the third axis until the rolling die meshingly engages with the workpiece,

rotating the rolling dies at a constant angular velocity about their associated first and second axes while engaged with the workpiece;

while performing step (d), maintaining continuous conjugacy between each of the rolling dies and the workpiece with the

involute surface of each tooth of each of the rolling dies engaging the involute surface of a mating tooth of the workpiece and the tooth tip of each of the rolling dies engaging the trochoidal root/fillet surface between adjacent mating teeth of the workpiece to effect material flow along the outer peripheral contoured surface;

continuing to advance each of the rolling dies in the in-feed direction thereby deforming the surface of each tooth flank and of a corresponding root/fillet region until a final net shape of each tooth and of each root/fillet region is achieved, and

continuing to perform all of the preceding steps with the rolling dies and workpiece meshingly engaged, thereby deforming the involute and trochoidal root/fillet surfaces of all of the teeth of the workpiece resulting in a final net shaped machine element.

10. (Original) A method as set forth in claim 9 including the step, before step (c) of:

advancing the workpiece in a through-feed direction parallel to the first, second, and third axes such that the outer peripheral profiled surface of the workpiece engages the outer peripheral profiled surface of each of the rolling dies and continues to advance until the workpiece is

positioned substantially coextensive with the rolling dies in the through-feed direction.

11. (Original) A method as set forth in claim 9 wherein the machine element being produced is a gear.

12. (Original) A method as set forth in claim 9 wherein the machine element being produced is a sprocket.

13. (Original) A method as set forth in claim 10 wherein step (c) includes the steps of:

simultaneously with step (g) after the workpiece and rolling die are substantially enmeshed, advancing the rolling die within a plane containing the first and second axes, in an in-feed direction substantially perpendicular to the first and second axes until the outer peripheral surface of the rolling die engages the outer peripheral surface of the workpiece at a near net shaped center distance establishing an initial center distance between the first and second axes when the workpiece and the rolling gear die are initially engaged; and

continuing to advance the workpiece in the in-feed direction by an additional increment of center distance thereby

deforming the profile surfaces of each tooth resulting in final net shape of the teeth.